Department of Toxic Substances Control

Edwin F. Lowry, Director
5796 Corporate Avenue
Cypress, California 90630

Winston H. Hickox
Agency Secretary
California Environmental
Protection Agency

Gray Davis
Governor

January 16, 2002

Mr. Mark Alling
West Coast General Manager
Phibro - Tech, Inc.
8851 Dice Road
Santa Fe Springs, California 90670

COMMENTS ON THE GROUNDWATER EXTRACTION AND TREATMENT PILOT STUDY WORKPLAN, PHIBRO-TECH, INCORPORATED
8851 DICE ROAD, SANTA FE SPRINGS, CALIFORNIA 90670
(EPA ID NO. CAD008488025)

Dear Mr. Alling:

The Department of Toxic Substances Control (DTSC) has reviewed your *Groundwater Extraction and Treatment Pilot Study Workplan*, dated June 29, 2001. This letter is to transmit the enclosed comments on the document, prepared by Ms. Laura Rainey, our Geologist for the site and Mr Laszlo Saska of our Engineering Services Unit.

Please submit responses to the comments and a revised workplan within forty-five (45) days from the date of receipt of this letter. Thank you for your cooperation. If you have any questions or need clarifications, please contact me at (714) 484-5423 or Ms. Kathy San Miguel at (714) 484-5380.

Sincerely,

Brian Lewis for K. Baker

Karen T. Baker, CEG, CHG, Chief
Geology and Corrective Action Branch

Enclosures

Certified Mail
7000 1670 0010 5814 5834
Return Receipt Requested

cc: See Next Page

cc: Mr. Larry Bowerman, Chief ✓
RCRA Corrective Action Office
United States Environmental Protection Agency
Region IX
75 Hawthorne Street (WST-5)
San Francisco, California 94105

Mr. Dwight Glover
President
Phibro - Tech, Inc.
One Parker Plaza
Fort Lee, New Jersey 07024

Mr. Steven Cohen
Vice President and General Counsel
Phibro - Tech, Incorporated
One Parker Plaza, 14th Floor
Fort Lee, New Jersey 07024

Mr. Edward A. "Chip" Vitarelli
Environmental Analyst
Paul Hastings, Janofsky & Walker LLP
345 California Street
San Francisco, California 94104-2635

Mr. Alonso Alatorre
Plant Manager
Phibro - Tech, Inc.
8851 Dice Road
Santa Fe Springs, California 90670

Mr. Zachary R. Walton
Attorney at Law
Paul Hastings, Janofsky & Walker LLP
345 California Street
San Francisco, California 94104-2635

Department of Toxic Substances Control

Edwin F. Lowry, Director
5796 Corporate Avenue
Cypress, California 90630

Winston H. Hickox
Secretary for
Environmental
Protection Agency

Gray Davis
Governor

MEMORANDUM

TO: Kathy San Miguel
Hazardous Substances Engineer
Geology and Corrective Action Branch

FROM: Laura Rainey, R.G.
Hazardous Substances Engineering Geologist
Geological Services Unit
Geology and Corrective Action Branch

DATE: January 8, 2002

SUBJECT: COMMENTS ON THE GROUNDWATER EXTRACTION AND TREATMENT PILOT STUDY WORKPLAN, PHIBRO-TECH, INC. 8851 DICE ROAD, SANTA FE SPRINGS, CALIFORNIA
EPA ID NO. CAD008488025

PCA 22120 Site Code 300142 Work Phase 00 MPC 31

Introduction

As requested, the Geological Services Unit (GSU) of the Geology and Corrective Action Branch (GCAB) at the Department of Toxic Substances Control (DTSC) reviewed Camp Dresser & McKee's June 29, 2001 *Groundwater Extraction and Treatment Pilot Study Workplan* (Pilot Study Workplan) for the above-referenced facility. The Pilot Study Workplan, prepared on behalf of Phibro-Tech, Inc. (PTI), proposes a pilot study to support design of a groundwater remediation system, as required by the facility's Hazardous Waste Facility Permit Modification (Permit No. 91-3-TS-002; Permit Modification No. 02, dated August 2, 1995). The Permit Modification requires the owner or operator to design, construct, operate, and maintain a groundwater remediation system to meet all groundwater cleanup standards required by the Permit Modification as well as any additional cleanup standards that may be imposed in the future.

While evaluating the proposed scope of work, GSU reviewed historical and recent information regarding site conditions to better understand the Site Conceptual Model

(SCM) for transport of contaminants. GSU identified key objectives for groundwater remediation and considered options for an approach towards attaining Permit and applicable regulatory compliance. GSU's comments regarding the SCM, key objectives for groundwater remediation, and recommended approach for groundwater remediation are summarized in the General Comments section below.

A significant amount of groundwater and soil vapor data has been collected at the facility since the Permit Modification was issued in 1995. Based on preliminary review of data collected to date (i.e., from approximately 1985 to present), it appears that the selected remedy (extraction and treatment of groundwater from the Hollydale aquifer) may warrant reconsideration. An alternative groundwater remedial approach should be considered that takes into account the overlying Gage aquifer, which may temporally and locally vary from unsaturated to partially saturated conditions. GSU recommends that the approach for groundwater remediation focus on contaminant source control. Based on soil matrix, soil vapor, and groundwater data, it appears that potential sources of volatile organic compounds (VOCs) to groundwater underlying the site consist of VOCs in soil vapor and soil matrix within the vadose zone, water infiltrating and leaching VOCs through the vadose zone, and migration of VOC-impacted groundwater from off-site sources. Potential sources of metals to groundwater appear to include metals present within the finer-grained lithologies above and below the water table, and water infiltrating and leaching metals through the vadose zone. Based on data collected to date, it appears that the Gage aquifer may have been partially saturated in localized areas. Therefore, VOCs within the aquifer can be a significant ongoing source of impact to groundwater in the underlying Hollydale aquifer. Data also indicates that metals in the fine-grained lithologies at the base of the Gage aquifer may also be a source of impact to groundwater in the Hollydale aquifer.

To address source control, GSU recommends the following: 1) update and revise the SCM to incorporate data for all media collected to date at the facility. The SCM should identify and address potential contaminant sources and their fate and transport to the Gage aquifer, the Hollydale aquifer, and other effected aquifers; 2) meet with DTSC to discuss the updated SCM and an appropriate remediation approach for the site. The approach should address contaminant source control in the vadose zone as well as within the Gage and Hollydale aquifers. At a minimum, GSU recommends design and implementation of a remedy for the vadose zone and the Gage aquifer for monitoring and removal of VOCs and metals. This approach may incorporate installation of shallow monitoring/extraction wells within the Gage aquifer. Monitoring and extraction of groundwater and soil vapor from the Gage Aquifer serves many benefits to PTI. It is an important element of source removal for metals and VOCs, plus it would move the facility forward in terms of attaining compliance for Permit requirements regarding groundwater and vadose zone monitoring and remediation.

In addition to proposing a vadose zone/Gage aquifer remedy, GSU recommends review

and possible modifications to the Hollydale aquifer monitoring system to ensure that changes in water quality resulting from implementation of the selected remedy can be adequately monitored. GSU is currently reviewing the status of the facility's monitoring network and associated Water Quality Sampling Plans, and will incorporate findings from the review into discussions regarding the facility's existing monitoring system and alternative remedial options for the Hollydale aquifer.

A teleconference call was held between DTSC and PTI's representatives on January 3, 2002 to discuss GSU's recommended approach for groundwater remediation. As a result, PTI agreed to the following: 1) provide an updated SCM; 2) complete Phase 2 of the soil vapor survey; 3) provide workplan for installation of additional monitoring/extraction wells in the Gage aquifer; 4) conduct a soil vapor extraction pilot test. Items 1 through 3 are anticipated to occur within the next few months. The soil vapor extraction pilot test is anticipated to occur after the first quarter 2002. GSU is scheduled to meet with PTI on January 23, 2002 to discuss and develop an outline for the updated SCM report.

General Comments

1. **Groundwater Remediation Objectives:** The Permit requires implementation of "corrective measures selected by the Department to remediate, monitor, and/or contain soil and groundwater contamination" at the facility. The objectives of any proposed scope of work should be remediation of constituents of concern (COCs) to applicable groundwater cleanup standards at applicable points of compliance (POCs). Section E. 2. of the facility's Permit Modification specifies requirements for groundwater remediation at the facility. This section requires remediation of "contaminated groundwater from the Hollydale and any other affected aquifers", and specifies two POC groundwater monitoring wells (MW-4 and MW-9). POC cleanup standards are listed in Section E.2. for the following: cadmium, total chromium, hexavalent chromium, tetrachloroethene (PCE), trichloroethene (TCE), 1,1-dichloroethene (1,1-DCE), 1,1-dichloroethane (1,1-DCA), 1,2-dichloroethane (1,2-DCA), trans-1,2-dichloroethene (1,2-DCE), 1,1,1-trichloroethane (1,1,1-TCA), and methylene chloride.

2. **Site Conceptual Model (SCM) for Transport of Contaminants:** The following information was not adequately addressed in the Workplan, but is included in this memorandum as a basis for the SCM:

   Description of Affected Aquifers: Based on data collected to date, fine grained materials of the Bellflower aquitard underlie the majority of the site to depths of 10 to 15 feet below ground surface (bgs). This aquitard is locally absent at a few locations and was reportedly excavated and backfilled with a higher permeability fill in the vicinity of the former Pond 1 area (near the location of the proposed

pilot test). The Gage aquifer occurs from approximately 15 to 30 feet bgs. The elevation of the base of the Gage aquifer is fairly consistent beneath the site, and is at approximately 117 feet mean sea level (msl) near POC well MW-4. An unnamed clay/silt layer separates the Gage from the upper Hollydale aquifer, and varies in thickness from less than 5 feet to 25 feet. GSU assumes that the locally thin extent of this aquitard could potentially result in local hydraulic interconnection between the Gage and Hollydale aquifers. The Upper Hollydale aquifer may thus be under locally unconfined to semi-confined conditions with respect to aquitard separating it from the Gage aquifer. Depending on the thickness of this aquitard, the top of the Hollydale aquifer underlies the site at depths ranging from approximately 30 to 55 feet bgs (i.e., elevations ranging from nearly 120 feet msl to 95 msl). A fine layer of clayey materials is encountered in the Hollydale aquifer at thicknesses ranging from 0 (in well MW-4A) to approximately 5 feet, and appears at varying depths ranging from approximately 50 to 70 feet bgs (i.e., approximately 100 feet msl to 80 feet msl). This layer divides the Hollydale into Upper and Lower aquifers. The thickness of the aquitard that separates the Hollydale aquifer from the underlying Jefferson aquifer is unknown, and is locally absent near the southwestern corner of the site. Where absent, it is assumed that an exchange of water occurs between the two aquifers. First-encountered groundwater beneath the site has historically been reported to occur in the Hollydale aquifer, and the overlying Gage aquifer has been reported as dry. However, elevated water levels observed throughout the site from 1993 through 1999 may indicate localized partial saturation of the Gage Aquifer. The majority of groundwater monitoring wells at the site are either screened in the Upper Hollydale or Lower Hollydale aquifer. Only one well (MW-6A) is screened in the Gage aquifer.

Historical Water Level and Water Quality Trends: Groundwater data from 1985 to present indicates that groundwater beneath the site is subject to significant water level fluctuations over short periods of time. Annual seasonal variation is apparent in the monitoring network's water levels throughout the entire history of monitoring. In addition, water levels follow trends that appear to correlate with overall changes in annual precipitation. The site's monitoring history is described by three separate time periods, as defined by observed general trends in water levels and water quality.

1985 through early 1993: The lowest water levels within the facility's monitoring history are observed for this time period, and were generally below the monitoring wells' screened intervals. Water levels show annual seasonal variations and an overall decreasing trend from 1985 to 1990, with an overall increasing trend from 1990 to early 1993, commensurate with increasing annual precipitation.

Detected TCE concentrations during this time period were generally highest in POC well MW-4. Through 1991, the highest concentrations of ethylbenzene were detected primarily in northern perimeter monitoring wells MW-11 and MW-3. As water levels increased after 1991, the highest ethylbenzene concentrations were primarily detected in POC wells MW-4 and MW-9. Historical maximum concentrations of hexavalent chromium were detected in well MW-4, with detected concentrations occasionally observed in wells MW-9 and MW-14S.

The RFI Phase I Report (CDM, May 29, 1992) indicates that approximately 1,000,000 gallons of groundwater were extracted from well EX-1 over a period of 6 months to one year some time between 1985 and 1987. The report indicates that groundwater extraction was discontinued due to "contamination from an off-site source". The most significant decrease in water levels during this period occurred from August 1985 through March 1986. Limited water quality data is available prior to March 1986 to evaluate trends. However, concentrations of ethylbenzene in well MW-3 rose significantly from <1 ug/L in August 1985 to 95,000 ug/L in March 1986. Since well MW-3 is located along the northwest perimeter of the site, this presumably was the data upon which the facility assumed migration of contaminants to the site from an off-site source. By July 1990, ethylbenzene significantly decreased to nondetect values in groundwater from this well. Ethylbenzene was also detected at significant elevated concentrations in groundwater from north-central perimeter well MW-11 from 1986 through 1992, but has shown a general overall decrease through July 2001.

A 31-hour constant discharge aquifer test was conducted using well EX-1 in March 1991 (CDM, May 29, 1992). A total of 92,714 gallons of water were extracted from the well at an average rate of 49.8 gallons per minute (gpm). Observed trends corresponding to this time period include a significant increase in ethylbenzene in groundwater from well MW-14S, located downgradient from the extraction well, and in well MW-4, located adjacent to the extraction well.

1993 through early 1999: From late 1992 to mid 1993 after a season of significant precipitation, water levels throughout the site significantly rose (12 to 13 feet), and subsequently exhibited seasonal fluctuations through 1999. The highest TCE and ethylbenzene concentrations during this period were generally detected in POC well MW-9. The maximum hexavalent chromium concentrations detected during this period were highest in POC well MW-4. During this period, total and hexavalent chromium concentrations in MW-4 appear to seasonally peak as the water level in this well lowered into clays within the aquitard between the Gage and Hollydale aquifer. This seasonal pattern may indicate the presence of chromium-impacted clays within the aquitard. The

highest seasonal chromium peaks, however, occur when the water table is beneath the aquitard, within the Hollydale aquifer. Insufficient lithologic data is available on boring logs for the Hollydale aquifer to evaluate correlation of water quality with lithology.

1999 to most recent (July 2001): Water levels in all of the shallow wells decreased nearly 12 feet from mid 1999 through early 2000 and have subsequently risen. The cause of this significant decrease in water levels is unknown, and does not appear to be simply a function of decreasing annual precipitation. During this period, the highest concentrations of TCE were detected in well MW-11. The highest ethylbenzene concentrations were detected in well MW-7 and more recently, in well MW-4. The highest hexavalent chromium concentrations continue to be observed in well MW-4, with detected concentrations also observed in well MW-9, as the water levels lowered through the thin silt/clay layer located between the Gage and Hollydale aquifer. Water levels appear to remain at elevations above the top of screened intervals for the monitoring network.

3. **Recommended Approach for Remediation:** GSU recommends that the approach for groundwater remediation focus on contaminant source control. When present at sufficient quantities, water infiltrating the vadose zone would reach the Gage aquifer prior to leaching down to the Hollydale aquifer. Historical groundwater data appears to indicate that the base of the Gage aquifer may have at times been partially saturated from early 1993 through early 1999, during periods of heavier precipitation. Historical water quality data shows a general increase in concentrations of aromatic and chlorinated VOCs in on-site shallow wells during the time period corresponding to partial saturation of the Gage aquifer. An on-site soil vapor survey conducted in March 2001 measured VOC concentrations in the Bellflower aquitard, the Gage aquifer, and the upper Hollydale aquifer. The soil vapor survey results (CDM, November 16, 2001), show that the highest detected concentrations of total VOCs generally occur within the Gage aquifer. Based on data collected to date, it appears that VOCs within the Gage aquifer can be a significant source of impact to groundwater. Data also indicates that metals in the fine-grained lithologies at the base of the Gage aquifer may also be a source of impact to groundwater.

To address source control, GSU recommends 1) design and implementation of a remedy for the Gage aquifer; 2) design and implementation of an appropriate monitoring system in the Hollydale aquifer; and 3) design and implementation of a remedy for the Hollydale aquifer. Within the Gage aquifer, shallow monitoring wells should be installed at a minimum, within the Gage aquifer at the POC areas. GSU will work with PTI in identifying other locations for installation of wells within the Gage aquifer. These wells should be used for vadose zone

moisture monitoring and serve as groundwater extraction wells for dewatering the Gage aquifer, should it resaturate. These wells should also be designed for use for soil vapor extraction for source removal of VOCs from the vadose zone.

GSU recommends meeting with PTI to discuss the approach for groundwater remediation at the site. Although the Gage aquifer is currently reported to be dry, a remedy that involves extraction and treatment of water from the Gage (should it resaturate) will likely require some form of a pilot test. Until the remediation approach is developed, it may be premature to propose a groundwater extraction pilot test; however, a pilot test may ultimately be necessary, and several important logistical issues can be addressed early on. For this reason, specific comments regarding the Pilot Test Workplan are included, and are summarized below.

Specific Comments

1. **Licensed Signature:** The Workplan should be signed by an appropriate California-licensed professional. The signature page should include the author's registration stamp and license number.

2. **Section 1 Introduction, Page 1-1:** This section should be revised to clarify groundwater remediation objectives and general approach. Refer to GSU's above General Comments.

3. **Section 2 Conceptual Model of Contaminant Migration, Page 2-1:** This section should be revised to address data collected to date for all media (i.e., soil matrix, soil vapor, and ground water) for contaminants of concern. At a minimum, as a basis for the SCM, the workplan should include the following: summary of historical water level and water quality data for entire monitoring period (1985 to present) for deep and shallow wells for all contaminants listed in the Permit; interwell and intrawell hydrographs and time series graphs showing water levels, top of screen interval, and contaminant concentrations for all monitoring wells for entire monitoring period; two site-wide geologic cross sections (north-south and east-west) showing lithology and construction details of all shallow and deep monitoring wells; list of dates of occurrence of all on-site groundwater extraction events from 1985 to present. The SCM should clearly describe all affected aquifers and the extent of hydraulic communication between the aquifers.

   Extraction Well EX-1 Construction Details: Regardless of the approach selected for groundwater remediation, construction details for well EX-1 must be provided in order to evaluate if the well is a potential conduit between the Gage and Hollydale aquifers. The workplan only listed the well screen interval based on

previous video logging (approximately 55 to 70 feet bgs), and provided no other construction details. If information confirming the presence and depths of the extraction well's filter pack interval and annular seal cannot be obtained, then GSU recommends abandonment of well EX-1, as it could potentially serve as a conduit between the Gage and Hollydale aquifer. If well construction details cannot be obtained, then a decommissioning workplan for well EX-1 should be submitted to DTSC for approval within one month from receipt of this memorandum.

4. **Section 2.2.1 Constant Discharge Aquifer Test, Page 2-2:** A good deal of relevant information and data is available from the 31-hour constant discharge aquifer test previously conducted using well EX-1 in 1991 (CDM, May 29, 1992). For example, difficulties were encountered with regards to pressure buildup of the carbon canisters and breakthrough of various contaminants. Two carbon canisters were initially hooked up in series; however, excessive pressure build up occurred in the first canister, resulting in flow through the safety bypass. As a result, only one canister was used at a time. Water samples collected during extraction indicated breakthrough (after the second carbon canister) of ammonia (nitrogen), nitrate (nitrogen), sulfide as sulfur, chloride, various metals, oil and grease, and methylene chloride. The workplan should address these issues. The workplan should also describe anticipated maximum drawdown and its effect on water quality.

5. **Section 2.2.2 Hydraulic Modeling, Page 2-3:** The hydraulic modeling referenced in the workplan is outdated, and presents conclusions that have not proven to be valid through the course of time. Input parameters used in the model did not adequately take into account spatial variations in contaminant distribution in various lithologies, nor spatial and temporal variations in water quality. It also did not adequately address the potential hydraulic communication between the Gage and Hollydale aquifers. In particular, the conclusion that chromium would naturally attenuate over a 10-year period (from 1992 to 2002) to concentrations less than 30 ug/L is not valid, as total and hexavalent chromium continue to be detected in well MW-4 as of July 2001, at concentrations of 11,900 ug/L and 14,000 ug/L, respectively.

6. **Section 3 Description of Pilot Study:** The Workplan needs to more adequately address the following issues:

Cleanup Standards: Applicable groundwater cleanup standards need to be described with a discussion included on how they will be attained.

Selection of Treatment Technology: An appropriate treatment technology needs to be selected for removal of VOCs from the extracted groundwater. The proposed use of granular activated carbon (GAC) is not likely to be appropriate, as it does not and take into account expected breakthrough times and changeout schedules for VOCs such as methylene chloride, 1,2-DCA, and 1,4-dioxane. Previous use of carbon canisters also encountered excessive pressure buildup. An alternative technology should be proposed to properly address these and other applicable issues.

Installation of Monitoring Wells: The workplan should propose installation of a sufficient number of monitoring wells into the Gage and Hollydale aquifers to allow monitoring at the POCs and at other critical locations. Ideally, the well design should allow for monitoring for the presence of water, monitoring of soil vapor, and be used for soil vapor and/or groundwater extraction.

Effluent Limitations: The workplan should include a copy of the current industrial wastewater discharge permit, showing effluent limitations for discharge of the treated extracted groundwater to the County Sanitation Department of Los Angeles County (CSDLAC) sewer line. The facility's Permit Modification has the following requirement for storage and discharge of treated groundwater: "extracted groundwater is to be treated to remove contaminants such that it meets requirements of any selected disposal option. Extracted groundwater to be disposed through the sewer system must be treated such that the contaminant concentrations meet applicable effluent discharge limits specified in the industrial waste discharge permit for the facility. On-site storage of extracted groundwater in tanks shall be conducted in accordance with requirements specified in the California Code of Regulations, title 22, section 66262.34. Since on-site reuse and discharge into the sewer system is a limiting factor to complete cleanup of site-derived contaminants in the Hollydale and other affected aquifers, additional disposal options should be proposed as a supplemental means for maximizing extraction and contaminant removal. Disposal of extracted groundwater must be conducted in accordance with all applicable requlatory requirements." The workplan should provide a detailed description of the process used for removal of metals from the extracted water to ensure that the effluent limitations will be attained. More information is needed regarding the process for removing metals from the extracted groundwater. More information is also needed regarding the maximum assumed proportion of facility process water that will consist of treated extracted groundwater, that will be used to allow for compliance with applicable effluent limitations.

Storage Issues: The workplan should adequately address various issues pertaining to storage of the partially treated extracted groundwater. These issues include storage of metals-impacted groundwater as potential hazardous

waste, as well as demonstration of sufficient storage capacity for extracted groundwater, particularly during rain events. Clarification should be provided to ensure that on-site storage of extracted groundwater in tanks will be conducted in accordance with requirements specified in the California Code of Regulations, title 22, section 66262.34.

7. **Section 4 Design Criteria, Page 4-1:** The groundwater extraction system should be designed with the intent of dewatering the Gage aquifer, in the event it should resaturate. Due to lack of monitoring wells in the POC area, no water quality data exists at this time for the Gage aquifer. A scenario must be described and used as a basis for design of the extraction, treatment, and storage of groundwater from the Gage aquifer. For mass-balance calculations, the assumed water quality should, at a minimum, represent the worst-case conditions historically observed in the Hollydale aquifer.

Thank you for the opportunity to comment. If you have any questions or require clarification, please feel free to contact me at (714) 484-5434.

Peer Reviewed:

Kate Burger
Hazardous Substances Engineering Geologist
Geological Services Unit

cc:

Alfredo Zanoria, CEG, CHG
Unit Chief
Geological Services Unit

Laszlo Saska, P.E.
Hazardous Substances Engineer
Engineering Services Unit

Department of Toxic Substances Control

Edwin F. Lowry, Director
8800 Cal Center Drive
Sacramento, California 95826-3200

Winston H. Hickox
Agency Secretary
California Environmental
Protection Agency

Gray Davis
Governor

MEMORANDUM

TO: Kathy San Miguel, Project Manager
Geology and Corrective Action Branch, Region 4
(714) 484-5380 FAX (714) 484-5411

VIA:
John Hart, P.E., Chief
Engineering Services Unit - HQ
(916) 255-6663 FAX (916) 255-3697

FROM:
Laszlo Saska, P.E., Hazardous Substances Engineer
Engineering Services Unit - HQ
(916) 255-6668 FAX (916) 255-3697

DATE: January 9, 2002

SUBJECT: *Groundwater Extraction and Treatment Pilot Study Workplan,* Phibro-Tech, Inc., by Camp Dresser & McKee, Inc., dated June 29, 2001

On October 23, 2001, you requested the evaluation of the above *Groundwater Extraction and Treatment Pilot Study Workplan* (Workplan) by the Engineering Services Unit (ESU). We have reviewed the Workplan and would like to offer the following for your consideration.

Please note that our review and analysis were limited to the engineering aspects of the Workplan. Thus, we primarily focused on Sections 3, 4, 5 and 6, and Appendix A of the Workplan. Furthermore, please note that our knowledge of other relevant issues surrounding the permitting of Phibro-Tech, Inc., is limited. Thus, there may be other issues which affect the technical efficacy of Workplan in whole or in part. Hence, additional engineering concerns and issues may surface in the future.

Summary:

The general intent of the Workplan is to propose a pilot study which will produce appropriate and defensible data of sufficient quality and quantity on which to base future site remediation approaches. Based on insufficient information presented in the Workplan, it is unclear whether that intent would be achieved.

The Workplan requires additional clarification and information to be considered a complete workplan for a groundwater pump and treat system pilot study. The Workplan requires revision of its contents to match its objectives. Additional design information is required on the groundwater extraction approach, as well as on the VOCs- and metals-treatment systems. Also, the groundwater quality- and level-monitoring program requires clarifying information to be considered complete.

For more specific recommendations, please see below.

Specific Comments:

1) Section 1, Introduction, page 1-1: The objective states that the Workplan was developed *"to collect data to determine the feasibility of remediating hexavalent chromium in the groundwater"*. However, the elements of the Workplan will not provide the data necessary to meet that objective.

The contents of the Workplan only cover, and partially at that, activities to verify previously estimated groundwater extraction rates and to monitor the treatment of volatile organic compounds (VOCs) using a granular activated carbon (GAC) adsorption system. The treatment of chromium and cadmium will apparently be left to an existing on-site treatment system. However, no description, analysis, or monitoring is proposed in the Workplan for the metals treatment system. We recommend that the objectives and the contents of the Workplan be reconciled.

2) Section 3.1, Project Description, page 3-1: In the first paragraph, the Workplan states that a "copper oxide process" will provide metals treatment for the groundwater exiting the GAC treatment system. Then, in the third paragraph, the Workplan states that the proposed *"Pilot Study will...assess the* [metals-treatment] *facility's ability to handle the proposed volume of groundwater"*. To accomplish that, we recommend that the Workplan provide details on the metals-treatment process, provide the criteria for the evaluation of its effectiveness in handling or treating the groundwater, and provide monitoring of the process.

3) Section 3.1, Project Description, page 3-1: In the second paragraph, the Workplan notes that "[p]*articulate filters may be installed before the GAC canisters to minimize fouling of the carbon...*" While this is a comparatively minor issue, we recommend that the Workplan provide a brief criteria or approach on how such a determination is to be made. We also recommend that the Workplan address the proposed type of filter and whether the filtration of particulates would affect the analysis of total chromium.

4) Section 3.1, Project Description, page 3-1: In the second paragraph, the Workplan states that "[t]*he VOC-treated water will then be pumped to three auxiliary rainwater collection tanks located on-site. The three above-ground FRP tanks have an approximate total capacity of 60,000 gallons.* This description contradicts the description on page 4-1, which refers to an "*existing rainwater collection pond*" for treated water collection. We recommend that the Workplan clarify the discrepancy and provide a more accurate flow description. We also recommend that the Workplan include storage considerations and how storage capacity at various points in the extraction and treatment process may affect treatment process operations.

5) Section 3.1, Project Description, page 3-1: In the fourth paragraph, the Workplan notes that if the proposed constant, 10-gallons per minute (gpm) groundwater extraction rate fails to be sufficient to produce a sufficiently large zone of influence, then a pulsed mode of extraction will be employed. The pulsed mode would consist of pumping at twice the initial rate, or at 20 gpm, but only for 50-percent of the time. We recommend that the Workplan present theoretical or modeling evidence to show how such a pulsed extraction approach would result in an increased zone of influence and whether the monitoring program is adequate to follow the effects of such a pulsed approach on the VOCs and metals plumes. We also recommend that the Workplan address the effects of such a pulsed operational mode on storage capacity at various points in the extraction and treatment process and the effects on the treatment process, including compliance with effluent limitations.

6) Section 4.1, Design Basis, page 4-1: Effluent limitations for each known or suspected organic components are not provided in the Workplan. It is unclear whether drinking water limits (MCLs) or industrial wastewater (POTW pre-treatment) requirements apply to the GAC effluent, as the final disposal method of treated water is not disclosed. We recommend that the Workplan provide minimum treatment requirements for all known or suspected organics. Furthermore, we recommend that other relevant inorganic groundwater constituents be addressed in terms of their effects on the treatment process and on effluent limitations. Also, we recommend that the final

disposal method of the treated water and any limitations or permitting thereof be addressed in the Workplan.

7) Section 4.1, Design Basis, page 4-1: The Workplan fails to specify the minimum size of the proposed GAC system for the given hydraulic and adsorptive requirements of the pilot study. Off-the-shelf GAC systems are readily available from several vendors. Most, if not all, vendors are able to determine the minimum GAC system size required for a specific application, based on both hydraulic and adsorptive requirements. We recommend that the Workplan include appropriate sizing calculations for the treatment system.

8) Section 4.1, Design Basis, page 4-1: The Workplan notes that the proposed GAC treatment system would be adequate for BTEX, TCE, PCE, and other similar VOCs. However, methylene chloride and 1,2-DCA may pose problems. We concur with this assessment. Of the above noted organic compounds, methylene chloride and 1,2-DCA will likely be the first two compounds to break through the GAC system. However, other organic compounds present in the groundwater but not mentioned in the Workplan could also break through or cause the breakthrough of other compounds due to competitive adsorption. The breakthrough time for individual compounds can be approximated using commonly available adsorption isotherms. The breakthrough time is important in properly sizing the GAC system (see Comment nos. 6 and 7, above), and to properly design the GAC monitoring program. For instance, if methylene chloride breaks through within days of startup, a weekly monitoring program will be of little value. Thus, we recommend that the Workplan include a comprehensive list of compounds known or suspected to be present in the groundwater, include appropriate adsorption calculations, and design the VOCs monitoring program according to appropriate breakthrough times and effluent limitations.

9) Section 4.1, Design Basis, page 4-1: The Workplan fails to provide process control description and design basis for the control of the groundwater extraction and treatment system and of the water storage units. The downstream metals-treatment system appears to be one of the controlling process units in the operation of the groundwater extraction and treatment system. Clearly, if the metals-treatment system is not functioning, or functioning at lower than normal capacity, or if storage capacity is unavailable, the groundwater extraction and treatment system will require flow adjustment or shut down. We recommend that the Workplan include details of the operational control of both the GAC and of the metals-treatment systems. We also recommend that the Workplan notes whether the GAC treatment system is to be located within a containment area.

10) Section 4.1, Design Basis, page 4-1: We recommend that the Workplan include minimal piping details, such as materials of construction, sizing, location and routing (above-ground or below ground), traffic load requirements, containment areas, storage capacities, etc.

11) Section 4.1, Design Basis, page 4-1: As touched upon in earlier comments, we recommend that the Workplan describe GAC change-out criteria should one or more VOC components or other organic compounds break through in excess of allowable effluent limitations during the pilot study.

12) Section 5.1, Groundwater Quality Monitoring, page 5-1: The description of Sample Point #1 implies that a bag filter is already part of the VOCs treatment system in contrast to what is included in Section 4.1, Design Basis. We recommend that this discrepancy be eliminated.

13) Section 5.1, Groundwater Quality Monitoring, page 5-1: As noted above, the design of the monitoring program must take into account considerations for the adsorptive capacity of the GAC canisters and as well as the effluent limitations of the individual VOCs, and of organic compounds in general. We recommend that the Workplan include breakthrough time calculations for all known or suspected individual organics, include effluent limitations, and, if necessary, revise the effluent monitoring program accordingly.

14) Section 5.1, Groundwater Quality Monitoring, page 5-1: We recommend that details on sample collection methods, containers, handling, storage, shipping, quality control, etc. be provided in the Workplan. A previously approved appropriate Sampling and Analysis Plan may also be used or referenced, if available.

15) Section 5.2, Groundwater Level Monitoring, page 5-1: Insufficient information is presented in this Section. We recommend that basic information such as the proposed schedule of monitoring, the monitoring well screen lengths and locations, distances of monitoring wells from the extraction well, etc., be presented in the Workplan. Furthermore, we recommend that the Workplan provide justification as to how the number, location, and construction of the selected monitoring wells and the frequency and type of their monitoring would produce appropriate and defensible data of sufficient quality and quantity.

16) Section 5.3, Post Groundwater Extraction Sampling, page 5-2: Please see Comment No. 15, above.

* * *

Should you have any questions or comments, please do not hesitate to contact me at the above number.